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Master thesis | Original study

The effect of suprainguinal fascia iliaca blocks on morphine use after total hip arthroplasty: a retrospective cohort study

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Abstract

Background: **Good pain control after total hip arthroplasty improves patient outcomes. Fascia iliaca blocks are used as part of multimodal pain management.**
Objectives: **We compared patient-controlled intravenous (PCIA) morphine use between patients with pre-operatively placed suprainguinal fascia iliaca compartment block (SFICB), using 40 ml ropivacaine 0.375%, and a control group (NB).**
Design and setting: **Retrospective, single-centre cohort study.**
Methods: **A database of the Imeldaziekenhuis in Bonheiden, Belgium was analysed. This database contained data of total hip arthroplasties performed between April 29 2019 and May 7 2021. Inclusion criteria were age >18 years and undergoing an elective total hip arthroplasty. The exclusion criterium was incomplete data registration. 277 patients were included in the study, 203 patients in the SFICB group and 74 in the NB group. A retrospective comparison between these two groups was performed.**
Main outcome measures: **The primary endpoint was PCIA morphine use at 24 hours. Secondary endpoints were PCIA morphine use between 24 and 48 hours, Numeric Rating Scale pain scores, peroperative sufentanil use, postoperative piritramide consumption and nausea.**
Results: **The median dose of PCIA morphine at 24 hours was 5 [2 to 9] mg in the SFICB group compared to 9.5 [5 to 15.75] mg in the NB group (P=0.000034). Lower pain scores at 48 hours (P=0.0003) and peroperative sufentanil consumption (P=0.015) were reported in the SFICB group. The median NRS pain score (P=0.02) and intravenous piritramide consumption (P=0.014) on the recovery ward were significantly higher in the SFICB group than in the NB group. No difference was reported for PCIA morphine use between 24 and 48 hours, pain score at 24 hours and nausea.**
Conclusions: **Preoperative suprainguinal fascia iliaca block leads to less PCIA morphine consumption the first 24 hours, lower NRS pain scores at 48 hours and lower peroperative opioid need for total hip arthroplasty.**

Keywords: **Arthroplasty, Replacement, Hip [Mesh],Analgesia, Patient-Controlled [Mesh], Nerve Block [Mesh] Pain, Postoperative [Mesh].**

Introduction

Total hip arthroplasty is performed to treat degenerative diseases of the hip joint[1,2]. High postoperative pain scores impede early rehabilitation and functional recovery[2-4]. Good peri-operative pain relief reduces complications, the length of hospital stay and improves patient outcomes[3]. Multimodal pain management, using a combination of paracetamol, nonsteroidal anti-inflammatory drugs, opioids and peripheral nerve blocks, is routinely used peri-operatively[5-7].

Preliminary data for this study were presented as a poster presentation at the ESRA Annual Congress, 22 to 25 June 2022, in Thessaloniki, Greece.
Ethical approval for this study was provided by the ethical committee (chairperson Dr Stijn Gysenbergs) of the Imeldaziekenhuis in Bonheiden (Imeldalaan 9, Bonheiden), Belgium (protocol number 211050) on October 12 2021.
Patients undergoing an elective total hip arthroplasty between April 29 2019 and May 7 2021 in the Imeldaziekenhuis in Bonheiden were included in this retrospective analysis.

The fascia iliaca compartment block, using either the suprainguinal (SFICB) or infra-inguinal approach, can be used as peripheral nerve block for total hip arthroplasty and is recommended in the PROSPECT guidelines of ESRA[8]. Several studies reported the efficacy of this block for the reduction of postoperative pain after total hip arthroplasty[9-11]. However, other authors have reported quadriceps motor block and suboptimal pain relief[12].

The primary aim of this retrospective study is to compare postoperative patient-controlled intravenous (PCIA) morphine use between patients with and without a pre-operatively placed SFICB after total hip arthroplasty in the first 24 hours postoperatively.

As secondary endpoints, we investigated PCIA morphine use between 24 and 48 hours postoperatively, Numeric Rating Scale (NRS) pain scores on the recovery ward, at 24 and 48 hours, dose of intravenous (i.v.) piritramide on the recovery ward, nausea and use of sufentanil during the procedure.

Methods

Ethical approval for this study was provided by the ethical committee (chairperson Dr Stijn Gysenbergs) of the Imeldaziekenhuis in Bonheiden (Imeldalaan 9, Bonheiden), Belgium (protocol number 211050) on October 12 2021.

For this retrospective, single-centre study the departmental database of the Imeldaziekenhuis in Bonheiden, Belgium was analysed. This database consisted of a total of 302 patients who underwent elective total hip arthroplasty between April 29 2019 and May 7 2021. Registered data included: age, peroperative opioid use, patient-controlled intravenous morphine use during the first 24 hours and between 24 and 48 hours postoperatively, Numeric Rating Scale (NRS) pain scores, nausea and use of anti-emetic drugs, use of i.v. piritramide on the recovery ward and use of paracetamol and nonsteroidal anti-inflammatory drugs. Inclusion criteria were as follows: age >18 years and undergoing an elective total hip arthroplasty. The only exclusion criterium was incomplete data registration.

The study population consisted of two groups: patients who received a pre-operative SFICB and those who did not (NB). A comparison between the two groups was then conducted. Our primary endpoint was PCIA morphine use at 24 hours. As secondary endpoints, we investigated PCIA morphine use between 24 and 48 hours postoperatively, NRS pain scores on the recovery ward, at 24 and 48 hours, i.v. piritramide consumption on the recovery ward, nausea and peroperative sufentanil use.

Ultrasound guided SFICB

All fascia iliaca compartment blocks were performed pre-operatively on an awake patient, with constant saturation monitoring. Routine practice in the Imeldaziekenhuis for performing a fascia iliaca compartment block is the suprainguinal (SFICB) approach, using 40 ml of ropivacaine 0.375%. Five mg of dexamethasone is always added as an intravenous additive. Using ultrasound-guidance, a 22 gauge Pajunk-needle is placed in the space between the fascia iliaca anteriorly and the iliopsoas muscle posteriorly. Proximal spread of the local anaesthetic has to occur in order to block the femoral, obturator and lateral cutaneous nerve of the thigh and provide adequate pain relief[13-15]. After pre-operative placement of SFICB, general anesthesia was performed on all patients for the total hip arthroplasty, due to routine practice in our hospital. Sufentanil or alfentanil are used in our hospital in combination with propofol and rocuronium for induction of anesthesia. For maintenance of anesthesia sevoflurane is used, maintaining a minimal alveolar concentration (MAC) of 1. Supplemental doses of sufentanil or alfentanil are administered peroperatively to treat acute peroperative pain.

Postoperative pain management

When nearing the end of the procedure, most anaesthetists already administer paracetamol and ketorolac i.v., according to patient's weight and barring any contra-indications. An intravenous loading dose of morphine is never given in our hospital peroperatively for total hip arthroplasties. From the moment the patient arrives on the recovery ward, they are interviewed about their NRS pain score (NRS = 0 meaning no pain, NRS = 10 meaning worst pain imaginable) and nausea (0 meaning no nausea, 10 meaning extremely nauseous) every 15 minutes. When their reported pain score is 4 or higher, additional pain medication is administered. If a patient has not yet received paracetamol or ketorolac i.v. peroperatively, these are given as first line treatment. Otherwise, i.v. piritramide is titrated per 2 mg. If a patient complains of nausea, 4 mg of ondansetron is given as first line treatment. All of this is standard protocol in our institution.

From the moment the patient reports NRS pain scores below 4 for 30 to 45 consecutive minutes, the PCIA morphine is started for discharge to the ward. The settings of our PCIA morphine are as follows: a bolus of 1 mg of morphine is given, with a blocked period of 6 minutes and a maximum dosage of 8 mg per hour. Every patient receives

PCIA morphine during the first 48 hours after total hip arthroplasty as their main pain management. Supplemental paracetamol, ketorolac or ibuprofen were given on demand. Additional subcutaneous morphine is never administered in our hospital.

At 24 and 48 hours postoperatively, a specialized nurse goes to check on the patients. She notes the amount of morphine they used, as well as asks them about their NRS pain score in that moment. The data she obtained during her round and the highest NRS pain score on the recovery ward, are used in this study.

Statistics

For all endpoints, the number of non-missing observations, mean, standard deviation, 95% confidence interval on the mean, median, first quartile, third quartile, minimum, and maximum were obtained in both groups. Data in the result section are expressed as mean ± SD and median [IQR]. The Shapiro-Wilk test strongly rejected the assumption of normality for all endpoints ($P<0.001$), hence statistical significance of the difference between both groups was assessed by the Mann-Whitney U test. Statistical significance was evaluated at the 5% significance level. No correction for multiple testing was performed for this exploratory study.

Results

Of the 302 patients in the database, 25 patients were excluded due to incomplete data. A total of 277 patients were included in our retrospective analysis. The SFICB group contained 203 patients, while the group without block contained 74 patients (NB) (Figure 1). The power of the study is 0.87. Age was the only recorded patient characteristic in our database. No significant difference ($P=0.91$) was found between our two groups, with a median age of 71 in both groups (SCIFB: 71 [63 to 78], NB: 71 [62 to 79]).

The median PCIA morphine use during the first 24 hours postoperatively in the SFICB group was 5 [2 to 9] mg, compared to 9.5 [5 to 15.75] mg in the NB group. The difference was shown to be statistically significant ($P=0.000034$). No significant difference ($P=0.72$) between the SCIFB (median: 3 [1 to 10.5] mg) and NB (median: 4 [0 to 11.5] mg) group was found for PCIA morphine use between 24 and 48 hours postoperatively (Figure 2 and Table I).

Piritramide is intravenously titrated on the recovery ward as the prime treatment of acute postoperative pain. The median dose of i.v. piritramide was significantly ($P=0.014$) higher in the SFICB group than in the NB group, 8 [4 to 12] mg vs. 6 [0 to 10] mg, respectively (Figure 3).

Pain scores were registered using the Numeric Rating Scale (NRS). The median NRS score on the recovery ward was significantly ($P=0.02$) higher in the SFICB group than in the NB group, 5 [4 to 6] vs. 4 [2 to 6], respectively. No significant difference ($P=0.11$) in pain scores was reported at 24 hours. At 48 hours postoperatively, significantly ($P=0.00036$) lower median pain scores were registered for the SFICB group compared to the NB group, 3 [2 to 3] and 3 [2 to 4], respectively. (Figure 4 and Table 2)

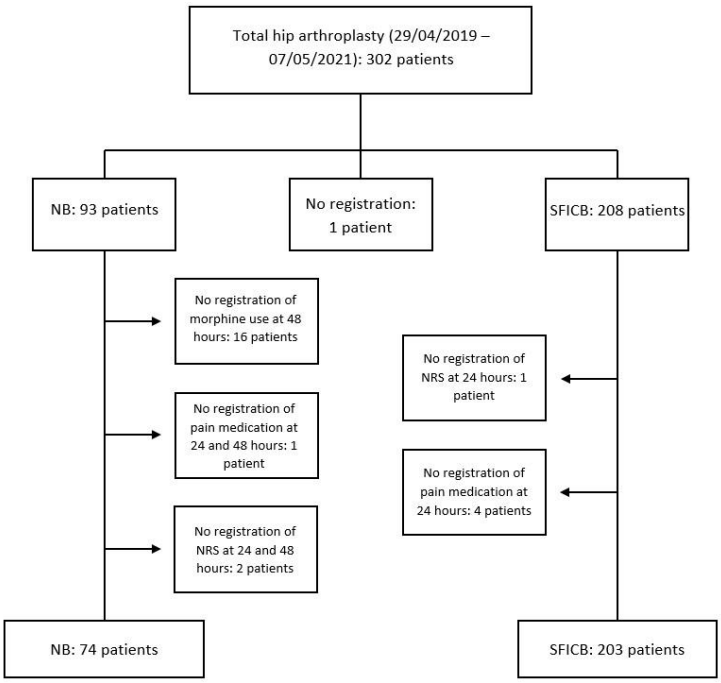

Fig. 1 — Flow chart of patient selection.

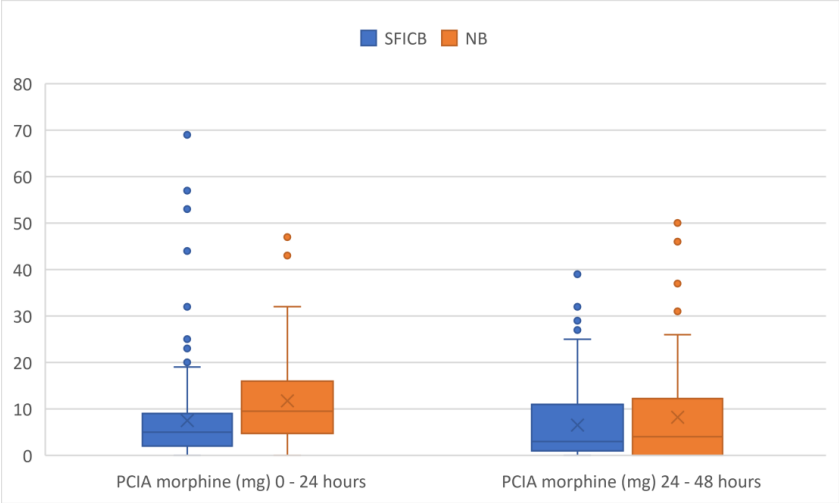

Fig. 2 — Boxplot of PCIA morphine use during the first 24 hours and between 24 and 48 hours.

Table I. — Descriptive data of PCIA morphine use during the first 24 hours and between 24 and 48 hours.

		Median	Q1	Q3	P-value
PCIA morphine (mg) 0 - 24 hours	SFICB	5	2	9	0.000034
	NB	9.5	5	15.75	
PCIA morphine (mg) 24 - 48 hours	SFICB	3	1	10.5	0.72
	NB	4	0	11.5	

The total incidence of nausea in our population was 14%. No significant difference (P=0.62) was seen between the SFICB group and the NB group. Likewise, the median dose of ondansetron after 24 and 48 hours in both groups is 0 [0 to 0] mg, with no statistically significant difference reported (P=0.08 at 24 hours vs. P=0.43 at 48 hours).

Sufentanil is the prime opioid used during total hip arthroplasties for induction and to treat intraoperative acute pain. The median total dose of sufentanil used in the SFICB group was significantly lower (P=0.015) than in the NB group (10 [10 to 15] µg compared to 10 [10 to 20] µg) (Figure 5). Also, no significant difference (P=0.38) was found in alfentanil use during the procedure. All patients received either sufentanil or alfentanil during the total hip arthroplasty. No patients received an opioid-free general anesthesia. Eleven of the 203 patients in the SFICB group received alfentanil as there sole opioid during the surgery.

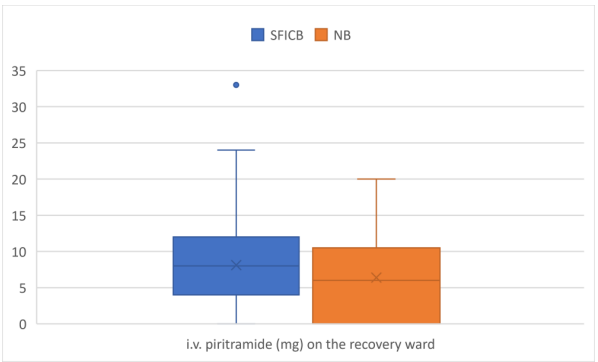

Fig. 3 — Boxplot of i.v. piritramide on the recovery ward.

The median dose of i.v. paracetamol administered during the surgery was 1 [0 to 1] g in the SCIFB and NB group. No significant difference (P=0.63) was found between the 2 groups. The same (P=0.37) was seen for i.v. ketorolac administration peroperatively, with a median dose in the SCIFB group of 30 [0 to 30] mg and in the NB group of 25 [0 to 30] mg. During the first 48 hours postoperatively, no significant difference between the 2 groups was found, considering supplemental ibuprofen (P=0.06) and i.v. ketorolac (P=2.2x10-10 to reject a significant difference) administration. Significantly (P=0.014) lower doses of paracetamol were administered to the SCIFB group (median: 3 [3 to 4] g) compared to the NB group (median: 4 [3 to 4] g) during the first 48 hours.

Discussion

In this retrospective study, we found that patients with a pre-operatively placed SFICB consumed significantly less PCIA morphine after total hip arthroplasty during the first 24

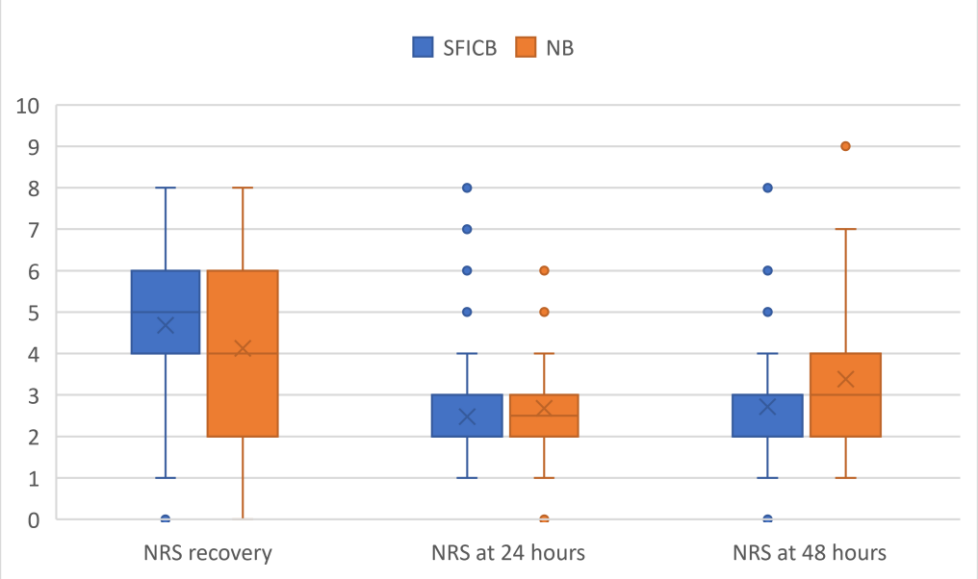

Fig. 4 — Boxplot of NRS on the recovery ward, 24 and 48 hours.

Table II. — Descriptive data of NRS pain scores on the recovery ward, 24 and 48 hours.

		Median	Q1	Q3	P-value
NRS on recovery ward	SFICB	5	4	6	0.02
	NB	4	2	6	
NRS 24 hours	SFICB	2	2	3	0.11
	NB	2.5	2	3	
NRS 48 hours	SFICB	3	2	3	0.00036
	NB	3	2	4	

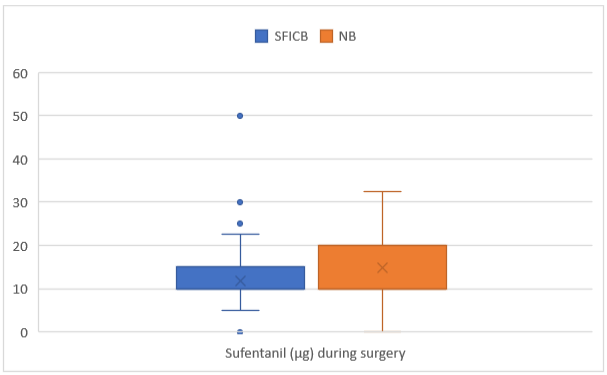

Fig. 3 — Boxplot of sufentanil use during surgery.

hours postoperatively than patients in the NB group. This finding is consistent with previous studies[9,11,16-18]. Pain is an endpoint that is difficult to quantify objectively. Therefore, we used the total morphine consumption during the first 24 hours as our primary endpoint in order to quantify the pain intensity, since this is an easily comparable parameter. However, this parameter is also influenced by a lot of confounding factors.

Sufentanil is used as the prime opioid for induction of anesthesia and treatment of intraoperative acute pain. Patients in the SFICB group received significantly less sufentanil peroperatively. This can be explained by the analgetic effect of the pre-operatively placed SFICB. However, since the treating anaesthetist placed the SFICB himself, the anaesthetist was not blinded to whether the patient received a SFICB or not. Therefore, there may have been an undertreatment of intraoperative pain in the SFICB group due to the expected effect of the SFICB. Furthermore, 11 of the 203 patients in the SCIFB group received alfentanil as their sole opioid during the total hip arthroplasty. These 2 factors can be a possible explanation for the higher NRS scores and i.v. piritramide consumption on the recovery ward in the SCIFB group. This differs from other studies, which mostly report lower pain scores in the first hours postoperatively[9,1,16-19]. At our institution, piritramide is intravenously titrated by the recovery ward nurses on patient's request and reported pain scores. Therefore, higher reported pain scores automatically coincide with higher piritramide consumption.

The reported failure rate of the SFICB in literature is 10 to 30%[14,17,20]. SFICB was introduced in the Imeldaziekenhuis in the course of 2019. In the beginning of the implementation, it is

reasonable to assume a higher failure rate of our SFICB than described in literature. Furthermore, every few months new anesthesia residents are taught the SFICB, which can cause a continuously higher failure rate of the SFICB in our institution. However, the performance of the block was not evaluated in the postoperative period in our study population.

No significant difference was found in NRS pain scores at 24 hours between the SFICB and NB group. This finding is supported by literature, which also describes no residual effect on pain scores at 24 hours after surgery[11,16-18,21,22]. However, significantly lower PCIA morphine use and i.v. paracetamol administration is found in the SFICB group during the first 24 hours postoperatively. Similar NRS pain scores are thus achieved in the SFICB group with lower doses of pain medication than in the NB group. This suggests an analgetic effect of the SFICB. It is probable patients deem a similar amount of postoperative pain as bearable and therefore do not try to achieve an even lower NRS score.

In our centre, SFICB are performed using 40 ml of ropivacaine 0.375% with 5 mg of dexamethasone added as an intravenous additive. The estimated duration of effect of this block differs between studies, but is in the range of 12 to 24 hours[23-25]. Therefore, the absence of a significant difference in PCIA morphine use between 24 and 48 hours postoperatively was to be expected. However, in our study population significantly lower NRS pain scores were found in the SCIFB group after 48 hours. Lower NRS pain scores are thus achieved with the same amount of pain medication. This may be due to the pre-emptive analgetic effect of the pre-operatively placed SFICB and avoidance of central and peripheral sensitization[26].

Postoperative nausea and vomiting (PONV) has an incidence estimated between 20 and 40%, depending on risk factors and preventing measures[27]. All patients in our study received 5 mg of i.v. dexamethasone as standard preventing measure. Only 14% of our population experienced nausea in the postoperative period, with no significant difference between the SFICB and NB group. Several previous studies reported a lower incidence of PONV after placement of a pre-operative SFICB[11,16,17]. Our study population and incidence of PONV were probably too small to replicate this finding.

The clinical significance of our findings may be controversial, since there is already extensive literature on this topic. This retrospective study duplicates some of the main findings of other studies, such as lower PCIA morphine use during the first 24 hours postoperatively after placement of SFICB. However, in our SFICB group significantly higher pain scores and i.v. piritramide consumption was seen on the recovery ward, which has not been described before. This was possibly due to lower doses of peroperative sufentanil and undertreatment of intraoperative acute pain. Our study can therefore help warn anaesthetists for possible bias considering intraoperative pain, when patients received a pre-operatively placed SFICB.

Limitations

Our study has several limitations. Firstly, a retrospective study is always more prone to selection and recall bias. We minimized this risk by using a pre-existing database without extracting new information from patient files. Furthermore, we only included patients with complete data, which diminishes the risk of selection bias, but does not completely eliminate it. Secondly, there is disparity between the number of study subjects in the SFICB group and NB group. The SFICB group consist of 203 patients, while the NB group consist of only 74 patients. This difference is caused by the rapid introduction of SFICB in our institution after starting the database. No difference was reported for the registered patient characteristics. The power of the study was adequate. Thirdly, the only patient characteristic registered in the used database was age. Since the used database was anonymous, other patient characteristics could not be retrieved. Therefore, doses of medication could not be corrected for patient's weight. Fourthly, the performance of the block was not evaluated in the postoperative period. Therefore, we cannot exclude a high failure rate of our SFICB, which would cause deviating results. Furthermore, due to the retrospective design we could not control supplemental administration of pain medication. Lower i.v. doses of paracetamol were reported during the first 48 hours in the SFICB group. The effect of the SFICB on PCIA morphine use and pain scores may therefore be underestimated in our study. Finally, the anterior approach for total hip arthroplasty is commonly thought to be less painful. In this study, no difference was made between the anterior and posterior surgical approach, since this information was not available.

Conclusion

This retrospective cohort study suggests the effectivity of the pre-operatively placed SFICB in reducing morphine use in the first 24 hours after total hip replacement. However, the impact on postoperative pain scores remains unclear. Further

research is needed to completely establish the role of the SFICB in the peri-operative analgesia for total hip replacement.

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Data sharing policy: We agree on sharing data reported in this study. For more information, please contact the corresponding author.

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